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|--|---|---------------|-------------------------------------|
|  | Measuring and calculating the flow rate of a stream | Date | xx/xx/2021 |
| Grade/level | Junior ages and up | Length | These will usually be 45-55 minutes |
| Brief Description | | | |
| Students will be guided on the simplified process of measuring the flow rate of a stream or easy top access riverbank. | | | |
| Guiding Question(s) | | | |
| 1. How do we calculate the flow rate of a stream? 2. Why does flow rate matter? | | | |
| Curriculum Connections (for grade 6) | | | |
| <p><u>Science & Technology</u> Understanding Life Systems: Biodiversity 1. Relating Science and Technology to Society and the Environment - 1.2 2. Developing Investigation and Communication Skills - 2.1, 2.4, 3. Understanding Basic Concepts - 3.2, 3.4</p> <p><u>Mathematics</u> A. Social-Emotional Learning Skills in Mathematics and the Mathematical Processes - 1-6 D. Data - D1 E. Spatial Sense - E2</p> <p>This lesson applies generally to all of our curriculum mapping. For more information, see https://waterrangers.ca/curriculum-mapping/</p> | | | |

| Learning Goals: | Success Criteria |
|---|---|
| <p>Today I will:</p> <ul style="list-style-type: none"> - Perform an experiment to find the speed of an apple flowing downstream - Measure the flow rate of a stream - Think about how flowing water may affect the ecosystem <p>Why?</p> <ul style="list-style-type: none"> - Water flow affects the environment - Flow can influence what kinds of life/pollutants will be present | <p>I can:</p> <ul style="list-style-type: none"> - Carry out the activity to find flow rate data - Calculate flow rate easily after finding the data - Measure, time, and verify their experiments - Engage with the water safely |
| Learning Skills and Work Habits | Learning Environment |
| <p>Responsibility Organization Independent Work Collaboration Initiative Self-Regulation</p> | <p>Outdoor education near a flowing body of water.</p> <p>This experiment could be done using a digital or drawn model as well, but the lesson is intended for in person instruction on or next to the water.</p> |
| Resources and Materials | Technology Integration |
| <p>Water Rangers secchi reel/tape measure Buoyant object (safe, like an apple) Notepad Pens Paper Calculator timer/phone</p> | <p>Phones, calculators or timers are needed. Students who have devices may use them for all measurements, and may record notes this way as well. Option to include a flow rate video for students to view: https://www.youtube.com/watch?v=uu94AVwQtHc&t=180s</p> |
| Considering any exceptionalities | |
| <p>Provide written summary of lesson to supplement instruction, in either note or digital form. When working near a source of open, running water, consider physical limitations of students with disabilities, as well as (but not limited to) any form of visual impairment.</p> | |

Lesson Breakdown

Introduction (10 minutes)

- Find a stream or river
- Sit with your students near the body of water, allow them to observe it and see its movement.

Why are we measuring flow rate?

- *Flow rate* is a measurement of how quickly a stream or river moves.
- A body of water that flows quickly will have different characteristics than a still one, like a pond.
- Fast flowing water can transfer nutrients and pollutants downstream to new places.

Lesson Body (20-30 minutes)

- Measure out a distance of a few metres on the shore next to the water.
- Mark off the start and end of your distance with sticks so you can see them!
- Drop your fruit upstream at the start of your measurement. Time how long it takes for it to reach the end of your measurement, in seconds.
- Explain how the formula works and how to calculate it.

In a formula we are looking at:

$$\text{surface flow rate } (v) = \frac{\text{length } (m)}{\text{time } (s)}$$

The closeout (10-15 minutes)

Questions for further understanding:

- Think about where your water flows *from*, and where it flows *to*.
- What can happen when water flows from one place to another?
 - Pollution
 - Plants/animals move
 - Current stirs up solids
- **Stretch task:** find out how many centimetres per second (cm/s) your object travels.